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Abstract

SAP is a major ERP Package that requires no introduction and research into the area is widespread and well reported. However, more and more reports are emerging of the failure of SAP as a package to meet the needs of business. This paper looks at the research of SAP for evidences of systematic research biases to see if that is the cause for such implementation failure being missed. A comprehensive literature search on SAP papers was undertaken with some alarming results showing a disturbing uncritical and possibly biased perspective from SAP Research literature.

Keywords: **SAP, Technological Determinism, Philosophical Foundations of Information Systems**.

Introduction

An AMR research study (Carlino, Neilson and Smith, 2000) projected that the ERP market will reach US$79 billion in 2004. The META Group (1999) found negative returns of US$1.5m over a five to six year period in 63 fortune 500. Despite such risks there is a world wide trend whereby large companies continue to find the promises of tangible and intangible benefits of ERPs so compelling they continue to make massive investments in such systems. Over the last ten years SAP has become the juggernaut of the ERP systems market with reports of successful (and not so successful) implementations across the globe as noted in Kraemmergaard and Rose (2002). The promise of SAP is to deliver an integrated Enterprise Wide System. Like all ERPs, SAP purports to help manage resources in an integrated manner, which in turn provides the capability to reengineer business processes using the technology as the "enabler". This is achieved by the seamless integration of infomation flowing across functions such as operations, finance and human resources (Davenport, (1990) Through integrating the existing Information Systems into a central platform, SAP is said to be able to give huge performance gains through improved business processes.

SAP is seen in business terms as an "integration" tool because it's aims is to bring together all the functions of the business (Al-Mashari and Al-Midimigh (2003)) into a central information-sharing platform. Such a practice allows the business to reshape and rethink the way in which it works and hence use the technology to make the whole business process more efficient. Efficiency leads to improved cost structures by faster product cycle times which in turn decreases work in progress, reduces the cost of inventory holdings and shrinks the amount of training and development required for human resources (see for example Hammer and Champy (1993), Avison and Fitzgerald (1996)) in particular pages 386-391). From this it can be argued that SAP is aimed at improving the business in terms of efficiency by making it possible to work faster and to be able to integrate information sharing across the organisation. However, the literature is very sparse on details covering the effectiveness of such an approach and especially thin in relation to what can happen as a result of implementing SAP systems from a research point of view.

Anecdotal evidence gathered by the authors from SAP users in a range of large organisations suggested there was considerable discontent with SAP. In particular many claimed they were frustrated by reframing the problem from something wrong with SAP to something wrong with them. A brief review of the literature revealed that it tended to promote SAP as a positive solution and how define post implementation difficulties as issues, which could be overcome by imposing well-defined structures. Post modernists argue problem definitions say more about power relationships than the problem being exposed. For example English history makes frequent reference to the Irish problem, whereas Irish history makes reference to invasion and domination. At a more practical level it has been demonstrated that a conceptual misspecification of a problem will make it very difficult to solve. (Flood and Jackson, 1991) The question, which began to emerge to the authors, was who defines the problem, what decision-making framework is used and what paradigm informs such a framework. Comprehending the ontological and epistemological assumptions which guided SAP research may provide some fresh insights into how to better solve such "problems" The case oriented papers seem to also agree that SAP is unquestionably not the problem (see Al-Mashari and Al-Midimigh (2003) and Kraemmergaard and Rose (2002) for example). Such an approach significantly limits the research agenda as it tends to exclude the possibility of asking more fundamental questions about SAP and the validity of the assumptions, which inform its practice. Altering the research agenda would open the debate to broaden notions of problem such as:

What are the long-term issues with SAP? Is SAP so far away from social realities that it will always struggle to have successful implementation? Does SAP carry with it a certain value set that makes assumptions about how business is to be done and how it should be carried out? Clearly this paper cannot answer all of these questions but it can begin to explore them and hopefully raise awareness as to what is going on in SAP research. The point of which is to understand the ontological, epistemological and axiological beliefs, which have informed practice and how this impacts upon the wider world in which it operates.

Methodology of the Study

As exposed in the Goles and Hirshhiem (2000) study into paradigms in IS research it seems as though Positivist research reigns supreme in the field. The work they present from Orlikowski and Baroudi (1991), Wilmott (1993) and Walsham (1995) all point toward a dominance in the field. This of course, ten years later is no difference despite the work of Klien and Myers (1999), Mingers (2001) and Lyytinen and Rose (2003) for example. The broader implications of what these authors suggest is outside the bounds of this paper but in terms of methodology though Mingers (2001) makes an interesting case for applying the use of multi-methodological research in Information Systems. Mingers (2001) suggests:

> Rather than advocating a single paradigm, be it interpretive or positivist, or even a plurality of paradigms within the discipline as a whole, it suggests that research results will be richer and more reliable if different research methods, preferably from different (existing) paradigms, are routinely combined together.

Taking the above advice we used a methodology that borrows from many different philosophies and paradigms. The first major analytical work comes from the Johnston and Duberley (2000). The schema and the definitions provided within the text were used to determine whether or not positivist bias existed in the SAP research. By matching up the corresponding epistemology and ontology, as shown above in the matrix the authors were able to determine on a higher level which SAP papers were overtly positivist. Secondly we use the theory of Technological Determinism and apply it to SAP based research to see if there is any evidence of such determinism in the research, after determining positivism. Before explaining the rest of the approach to the research a brief digress into technological determinism is required.

Technological Determinism

The basic underlying principle is that technology as a "force" drives social change (Young, 2003). Put more simply, technological determinism is a theory that suggests technology as a force makes change happen and influences the world in which we live. This concept is comparable to the technology as an enabler concept or that SAP is the "force" of social change or the driving "instrument" for change. Jacobs (2001) argues that this view discusses technology as being autonomous and that the theory describes a reality where technology influences us and we don't influence technology. In social terms society reacts to changes in technology as opposed to society creating technology for its use. Such a determinist view of technology infects the value set that informs SAP to the extent where it even makes assumptions about how work is to be carried out. Goles and Hirshhiem (2000) suggest that determinism is a positivist assumption that humans are a product of the environment in which they live. In technology terms this would mean that humans do not shape the technology they use but are shaped by the technology they use. In SAP terms this would mean that SAP shapes the action taken based on the impact it has on the social environment its placed in, instead of being shaped by the humans that put it into it's environment. If this is the case, researchers should be aware of this and examine it critically so as to assess the possible social impact of such an assumption. From this assumption the first level of analysis can be extracted as the following question:

1. Does SAP research outwardly display technologically determinist qualities OR is SAP seen as a solution, unquestionably and uncritically? Do you mean – is SAP researched informed by TD or is it something else?
2. If the latter then what is it and what are the consequences?

The point of this is to uncover the possibility that SAP research suggests that no problems exist with the ERP software. This would mean that the problem is external to the technology and lies with some other element, possibly social or even some kind of improper implementation. If this kind of thinking is uncovered then the research to date could be argued to be technologically deterministic because it views technology as a force for change more so than as a facilitative social constructed reality. That is, the technology (SAP) is the autonomous force that needs to be adhered by the social systems to as opposed to the social system adjusting the technology on a needs basis (the social construction of technology). The theory and definitions from above are derived from Jacobs (2001) discussions on

what technological determinism is and therefore any questions found have to find fit this definition. This is to reduce the possibility of author opinions creeping in and to make sure that the definitions are tested again "valid" sources. The main theme of the paper therefore would have to be toward the technology being an infallible solution. If this point is found, then it can be argued that determinism exists in SAP based research that might possibly be considered non-deterministic, which leads to the next question:

3. Does this paper represent a bias towards any particular research paradigm?

This question aims to uncover, from the literature, how SAP based research might be biased in philosophical and paradigmatic orientation. The main focus of this question is to understand the levels of assumption inside SAP research to uncover the possibility of bias toward a particular school of thought. When considering this, the other main area of interest is the language used in the paper. To reduce the possibility of bias, use was made of the Goles and Hirshhiem (2000) definitions of determinism and further the definitions provided in the seminal text by Burrell and Morgan (1979). The aim of such an exercise is to reduce the possibility of opinion or bias therein creeping into the research. Foucault (1972,1973) presented a theory of power relations suggests that situations humans live in and exist in are informed by texts that shape the discourse that comes from such situations. In other words as Harvey (1998) puts it:

> His aim is to explain how situations determine language and, consequently how language forms and maintains situations.

The use of language, the use of certain kind of words and the way in which language is used to develop models of "reality" as argued through the work of Foucault is applied to this literature to see what kind of "reality" is presented via the texts. The authors explicitly looked at the use of language that represents functionalist thought, according the definitions from the above-mentioned texts. The main point here was to understand what kind of research paradigm each individual paper presented. If it was found to be functionalist in orientation it would be so because of the language used. Out of each paper key phrases are extracted to represent the point. From these phrases a case can be made that the orientation of the paper is functionalist, if Foucault is to be believed.

4. What kind of reality does the literature represent?

This question is based on 2. and from this a picture should emerge as to what SAP researchers hold as their model of reality or at the very least how SAP research is presented in the literature. However, this "reality" is only in terms of what can be uncovered through the assumptions of 1 and 2 in a single paper. If the paper was biased and all others aren't – then the authors have an unfair generalization.

How the test was conducted

Given that the main output of research is publications, the literature available on SAP was tested through four main scientific search engine sources. The first (1.) Proquest Computing was used, followed by (2.) Kluwer (3.) Science direct and (4.)[1] ACM. The term "SAP" was keyed into the search engine, using a full text and citation search each time. The years 1998-2004 were studied as being relevant with no additional text criteria. Only papers that talk about SAP or have the SAP theme were examined or have the term "SAP" in the keywords or citation were used.

Evaluating the test questions

Each question from the above list of three was used to evaluate the situation at hand. Jacobs (2001) view on technological determinism was used to evaluate question 1. That is every paper that had technological determinist qualities had to match Jacobs (2001) description of it. To evaluate question 2. Goles and Hirschhiem (2000) present the assumption (based on Johnston and Duberley's (2000) work), that functionalist though is one that revolves around the idea of "laws" establishing cause and effect and that there is one reality. If this kind of thinking was included in the research then it was determined to be functionalist. This was evaluated by looking at the text to see the way in which SAP

[1] These were the only ones available to the author

is talked about, if at all. In each case the paper was examined to see what kind of language was used and if it was maintaining a "status quo" of some sort. As a means of summary out of the sampled years the literature was examined as for the overwhelming features over the whole body. Checkland and Holwell (1998) termed the concept "frameworks of ideas" (common perceptions or concepts) that the search uncovered. A table summarizing the research process is outlined in Table 1

Table 1 – Questions used to define SAP literature

Question	Evaluation Technique	Search Procedure
1. Does SAP research outwardly display technologically determinist qualities?	Compare papers to Jacobs (2001) definition to see what orientation it has	Proquest, Kluwer, Science Direct random sample of journals published with "SAP" keyword from 1998-2004
2. Does the paper represent a bias towards any particular research paradigm?	Use the Goles and Hirschhiem (2000) and Johnston and Duberley (2000) definition of functionalism to see what orientation it has. Researchers looked Look at the words used and make a judgment made based on above definition. (see example table below for some examples)	As above
3. What kind of reality does the literature represent?	Exam the most common frameworks or concepts used in the literature and see what is revealed	As above

Table 1 Methodology of the Study

For question 2 the research paradigm was based on what Goles and Hirshhiem (2000) consider to be the most dominant, that of functionalism. The authors realise that three other paradigms are discussed in the aforementioned paper but for the purposes of argument and discussion only the dominant paradigm is used in the analysis. In order to avoid possible confusion the authors have shown some examples of how papers were found to be of the dominant (functionalist/positivist) orientation.

Paper	Quote
Periera (1999)	"A second prescription which emerges from the analysis is that it is preferable to modify the business processes of the organization to fit the capabilities provided by the SAP system, rather than modify the SAP system to fit the reengineered business processes of the organization."
1. Gulledge and Sommer (2004)	" As demonstrated in the test of our hypothesis", "We test our hypothesis by performing an analysis of two US NAVY SAP implementations", "all efforts were made by senior leadership to implement a properly aligned SAP solution"
Kimms (2003)	"We need to prove formally that the presented network is equivalent to the standardization problem. We do this by induction"

Table 2 Examples of Understanding functionalism from Literature

The data is based on the complete set from January 1998-June 2004, with all papers analysed. Those papers that didn't pass the test were included in the analysis so an even model of the research could be presented. Each paper was rated out of 100 with both questions being worth 50 each. At the end of the analysis the authors examined the total percentage of the literature sampled to see what amount was by definition to be technologically determinist and functionalist. The test is as such that it meets the

definition completely and not partially. If any paper met the definition of either 1 or 2 is it said to be in that category. The researchers then used this data and the phrase sample provided to present what kind of reality dominated the research and to draw out this implications for discussion in the conclusion section of the paper.

Results

Using the criteria in Table 1 search retrieved 40 relevant articles from the search engine and these are listed in order of retrieval in the appendix. Of the ones sampled approximately 32 or 78% of the articles met the definition of Technological Determinism according to Jacobs (2001). This meant that 78% of the articles did not question SAP or made statements like the following retrieved from Shanmugam et al (2000) table 3 below:

Comment 1.	Complete business processes with consistent quantity and value flows…
Comment 2.	Businesses must continually check and improve their internal operations
Comment 3.	Quality is no longer "checked" but produced
Comment 4.	During software production, quality assurance is integrated into the processes, from design through development and release to maintenance of installed system.

Table 3 Examples of comments from text

Table 3 shows some of the more common statements made by authors. However the most common overlooked area by the texts was the overt nature of the determinism in SAP or the way business processes have to fit into SAP. Some investigated this as a possible problem (for example see Skok and Legge (2001), Kawalek and Wood-Harper (2002) and Avital and Vanderbosh (2001). However, in the 78% of cases where it was found this was not discusses or raised as an issue.

In research terms, on a first glance the raw figures tell a different story, 58% of the articles represented a positivist methodology whilst the rest 42% had a slightly different presentation (different in what way and against what??) . This seems odd when 78% match the technological determinist framework, so a further investigation revealed something else that was interesting. 12 articles were found to present SAP in a determinist light but then go onto report findings in a more interpretive mode, such as a case study or another type of interpretive research methodology. A closer reexamination revealed that the majority of these case studies defaulted back to the determinist position but manipulated the case study methodology to represent one side of the implementation rather than a value free interpretive study or a other type of qualitative research approach. This problem suggests that the other 12 articles (or 20%) were still functionalist and the finding of determinism leads to the conclusion that they could possibly be nothing more than partially disguised advertising for the SAP product. In essence, the researchers in this regard are coming from a fixed frame of reference that SAP is good and it is other issues that need to be found because the SAP??? Is not a problem, despite the case study methodology used. Consider the following examples:

> "Because the implementation of a cross-functional ES results in major organizational changes, our model is based on forces influencing change." (Scott and Vessey, 2002).
>
> "This approach fulfilled ASAP's [SAP Development Methodology] need for the creation of a business impact map as part of the ERP implementation change management process. We conjecture that BSPA [Alternative development Methodology suggested by Authors] could play a similar role in any evolutionary systems development methodology." (Panagoitidis and Edwards (2001))
>
> "The goals of the SAP University Alliance Program are to increase the number of students graduating from colleges and universities that are "job ready" with SAP knowledge, and to gain a presence in college and university curricula." (Corbitt and Mensching (2000)

> "By creating a centralized database and standardizing corporate data flow, ERP can make changes and efficiencies take root in a firm ... Even with such advances project managers often wonder ''what are the ingredients of successful system implementation?'' (Manadal and Gunasekeran (2003))

Statements like this show heavy bias in the work and the almost predetermination of the results before the situation can be properly observed. Even as a form of action research such comments might be considered predetermined. The findings were not altered, but for the sake of balance and consistency, papers like the one above are categorized as being Technologically Determinist but using so-called exploratory methods or case methods to explore that kind of determinist reality. This leaves such papers as questionable as to their orientation but it is strongly evident that they are based in a kind of closet functionalism. The results therefore are now presented.

Paper	Search Engine	Publication Date	Q1	Q2	Score
1. Gulledge and Sommer (2004)	Proquest Computing	Jul-04	50	50	100
2. Kimms (2003)	Proquest Computing	Jun-03	50	50	100
3. Haven and Coppel (2003)	Proquest Computing	Jun-03	50	50	100
4. Vessey and Scott (2002)	Proquest Computing	Apr-02	50	0	50
5. Panagoitidis and Edwards (2001)	Proquest Computing	Dec-01	50	0	50
6. Shanmugam et al (2000)	Proquest Computing	Oct-00	50	50	100
7. Grimson et al (2000)	Proquest Computing	Jun-00	50	50	100
8. Taudes et all (2000)	Proquest Computing	Jul-00	50	50	100
9. Beccerra-Fernandez et al (2000)	Proquest Computing	Apr-00	50	50	100
10. Haven et al (1999)	Proquest Computing	Dec-99	50	50	100
11. Andera et al. (1999)	Proquest Computing	Oct-99	50	50	100
12. Brooks et al. (1998)	Proquest Computing	Dec-98	50	50	100
13. Corbitt and Mensching (2000)	Kluwer	Aug-00	50	0	50
14. Hayman (2000)	Kluwer	Jan-00	50	50	100
15. Kræmmergaard and Rose (2002)	Kluwer	Jan-00	50	0	50
16. Vessey and Scott (2000)	Kluwer	Aug-00	50	0	50
17. O'Leary (2004)	Science Direct	May-04	50	0	50
18.Yusuf et al. (2004)	Science Direct	Feb-04	50	0	50
19.Tchokogue et al (2004)	Science Direct	Jan-04	50	0	50
20. Manadal and Gunasekaran (2003)	Science Direct	Apr-03	50	0	50
21. Pui Ng et al (2001)	Science Direct	Aug-01	50	50	100
22. Gulla and Brasthevik (2002)	Science Direct	Sep-02	50	50	100
23. Manadal and Gunasekaran (2002)	Science Direct RS	Jan-02	50	0	50
24. Quottrone and Hopper (2001)	Science Direct RS	Dec-01	0	0	0
25. Boykid (2001)	Science Direct RS	May-01	50	50	100
26. Krumbholz and Maiden (2001)	Science Direct RS	May-01	0	50	50
27. Deneva (1999)	ACM Digital Library	May-99	50	50	100
28. Otto (2002)	ACM Digital Library	Jun-02	50	50	100
29. Hanseth and Braa (1998)	ACM Digital Library	Dec-98	0	0	0
30. Sieber et al (1999)	ACM Digital Library	Jan-99	50	50	100
31. Periera (1999)	ACM Digital Library	Jan-99	50	50	100
32. Mohraz (2000)	ACM Digital Library	Nov-00	50	50	100
33. Avital and Vandenbosh (1999)	ACM Digital Library	Jan-99	0	0	0
34. Vogt (2002)	ACM Digital Library	Mar-02	0	0	0
35. Kawalek and Wood-Harper (2002)	ACM Digital Library	Feb-02	0	0	0
36. Hawking and McCarthy (2000)	ACM Digital Library	Dec-00	50	50	100
37. Jones (1998)	ACM Digital Library	May-98	50	50	100
38. Skow and Legge (2001)	ACM Digital Library	Apr-01	0	0	0
39. Askenas and Westilias (2000)	ACM Digital Library	Dec-00	0	0	0
40. Ross (1998)	ACM Digital Library	Dec-98	0	0	0

The final analysis is below:

Technologically Determinist	31	78%
Functionalist Orientation	23	58%
Non-TD	9	23%
Non-Functionalist	18	45%
So Called "exploratory study"	12	30%
Non-TD or Functionalist	8	20%

On face value 78% of the articles are informed by technologically determinism with 22% not informed by technological determinism. Thus revealing a large bias towards technological determinism in the sampled literature. Papers that were functionalist in research orientation were about 58%. It would make more sense to rate that at about at 88%, given the issues mentioned above with so-called exploratory studies. Papers that were not considered to be deterministic or functionalist were in short supply. They accounted for only 20% of all papers surveyed. This raises some interesting questions for SAP research.

Discussion

The literature demonstrated that SAP has an overwhelming positivist and technologically determinist bias. However such a perspective has been demonstrated to have numerous limitations in terms of the type and nature of research it permits. The most telling limitation being the way such perspectives treat or more aptly ignore social system. Critical theorists from the Frankfurt school have consistently highlighted the problems associated with a "positivist, uncritical human science which ignores the capacity of a society itself and treat it as a mere object to be observed. While accepting that individuals can be treated as objects in disciplines such as medicine and biology they make the point that "society is irreducible to the status of an object" (Dant, 2003). Society is dynamic and self organizing and as such is an open system. SAP like all ERPs is situated predominately in large organizations and as such is located in large communities. As such it cannot continue to ignore such the sociological aspects or treat them as mere objects.

Social systems are dynamic and self organizing and always changing. SAP research with its strong positivist bias sees society as a closed system, whereas societies operate as open systems. The ontology of SAP needs to be realigned to be able to conduct research in such a reality. This will require open up the debate by employing non-positivist epistemological methods. Given the massive investment in SAP and ERP systems in general combined with the range of costly failures such research is urgently required in order to generate fresh insights into how to realize the potential of ERP which has promises so much yet to date has delivered so little.

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